N

STEP 2

STEP 3

CAN DO WITH 90'
RADIUS, 80K
COUNTERWEIGHTS

MAY ALSO USE ATC3210 TO PICK SECOND
LAST GIRDER SECTION

ATC3210

138 HSL
80-TON

138 HSL
80-TON

RTC 80110

75.0

TOP OF SLOPE DOWN
TO ABUTMENT

G1-A
G2-A
G3-A
G4-A
G5-A

G1-B
G2-B
G3-B
G4-B
G5-B

PICK POINT

SPLICE 1

38.0

G1-C
G2-C
G3-C
G4-C
G5-C

PICK POINT

SPLICE 2

43.0

G1-D
G2-D
G3-D
G4-D
G5-D

SPLICE 3

45.0

PICK POINT

G1-E
G2-E
G3-E
G4-E
G5-E

SPLICE 4

PICK POINT

70.0

RTC 80110

HOLDING CRANE FOR
FIRST GIRDER. HOLD IN
CENTER OF SPAN.
GET CRANE AS CLOSE
AS POSSIBLE, TYP.

40.0

RTC
8050

PICK POINT
LOCATION (TYP.)

FIELD SPLICE
LOCATION (TYP.)

RTC
8050

HOLDING CRANE FOR
FIRST GIRDER. HOLD IN
CENTER OF SPAN

RTC
8050

HOLDING CRANE FOR
FIRST GIRDER. HOLD
NEAR CENTER OF
GIRDER E

STOWE STREET

THATCHER BROOK

STEP 1

GIRDER INSTALLATION SEQUENCE:
SET TWO GIRDER SEGMENTS AT A TIME, STARTING WITH G5, TO BE HELD IN
PLACE BY A HELPER CRANE WHILE G4 IS SET.
SPLICE GIRDERS IN THE AIR.
SET G3 TO G1 IN ORDER, WITH DIAPHRAGMS ATTACHED TO GIRDERS AS THEY
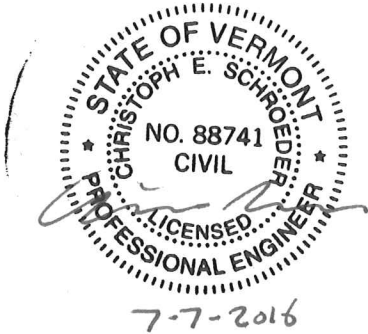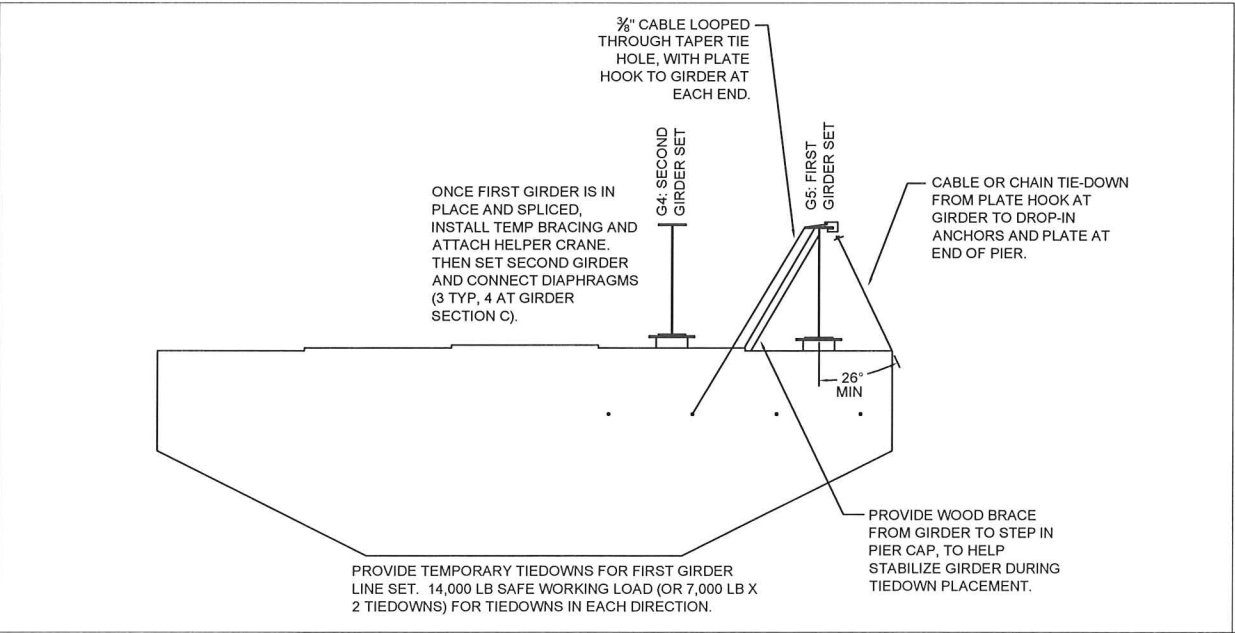ARE PICKED.

NOTES:

GIRDERS A, C, AND E MAY BE LIFTED WITH EITHER 15-TON OR 25-TON BEAM
CLAMPS.
GIRDERS B AND D WILL BE LIFTED WITH 25-TON BEAM CLAMPS.
GIRDER C REQUIRES USE OF A MIN. 16' LONG, 16-TON SPREADER BEAM AND
RIGGING.
THE OTHER GIRDERS MAY BE PICKED FROM A SINGLE POINT.

CONNECT BETWEEN GIRDER LINES WITH 3 DIAPHRAGMS PER GIRDER SECTION
TYP, AND 4 DIAPHRAGMS ON GIRDER SECTIONS C.
CONNECT SPLICE AND MAKE DIAPHRAGM CONNECTIONS BEFORE RELEASING
CRANES FROM A GIRDER LINE.

SET STEEL WHEN WINDSPEEDS WILL NOT EXCEED 30 MPH, OR PER CRANE
OPERATING REQUIREMENTS. LOWER WINDSPEEDS MAY BE NEEDED FOR SAFE
HANDLING OF STEEL.

GIRDERS	LENGTH	GIRDER WEIGHT	ADD FOR RIGGING	ADD FOR DIAPH/SPLICE	WEIGHT TO SET	138HSL MAX. RAD.	RTC80110 MAX. RAD.	ATC3210 MAX. RAD.
A	82	20,000	2500+750	885+1300	25,435			70
B	89	31,200	2500+750	885+1300	36,635	38		
C	108	26,150	2500+1200	1,180	31,030	43		
D	89	31,300	2500+750	885+2600	38,035		45	
E	70	17,100	2,500	885	20,485		70	75

⅜" CABLE LOOPED
THROUGH TAPER TIE
HOLE, WITH PLATE
HOOK TO GIRDER AT
EACH END.

ONCE FIRST GIRDER IS IN
PLACE AND SPLICED,
INSTALL TEMP BRACING AND
ATTACH HELPER CRANE.
THEN SET SECOND GIRDER
AND CONNECT DIAPHRAGMS
(3 TYP, 4 AT GIRDER
SECTION C).

G4: SECOND
GIRDER SET

G5: FIRST
GIRDER SET

CABLE OR CHAIN TIE-DOWN
FROM PLATE HOOK AT
GIRDER TO DROP-IN
ANCHORS AND PLATE AT
END OF PIER.

26°
MIN

PROVIDE WOOD BRACE
FROM GIRDER TO STEP IN
PIER CAP, TO HELP
STABILIZE GIRDER DURING
TIEDOWN PLACEMENT.

PROVIDE TEMPORARY TIEDOWNS FOR FIRST GIRDER
LINE SET. 14,000 LB SAFE WORKING LOAD (OR 7,000 LB X
2 TIEDOWNS) FOR TIEDOWNS IN EACH DIRECTION.

SHEET 1 OF 1

TITLE:
46A STEEL ERECTION PLAN

PROJECT: WATERBURY IM 089-2 (43)

SCALE: 1" = 40'   DATE: JULY 7, 2016

BECK & BELLUCCI, INC.
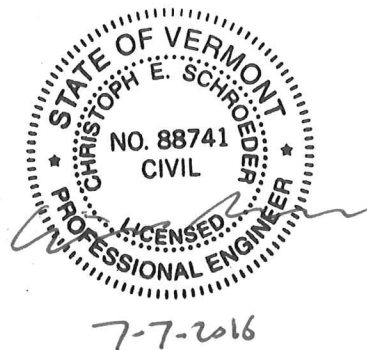FRANKLIN, NEW HAMPSHIRE

CALCULATIONS FOR:

Waterbury, VT IM 089-2(43)
506.55, Structural Steel, Plate Girder

Steel Handling and Erection Plan

July 7, 2016

Prepared by:

Christoph Schroeder, P.E.
Beck and Bellucci, Inc.
10 Salisbury Rd.
Franklin, NH 03235

Design References:
    NHDOT Standard Specifications, Section 550 (for girder stability)
    LRFD Steel Design, 2nd Ed., by William T. Segui
    LRFD Design Manual, by the AISC

Plans and Specifications:
    VTrans Contract Drawings
    ARC Steel Shop Drawings

Description of Work:
    The bridge is multiple spans. Provide temporary lateral support for the first girder line placed while placing the second girder line. Set the first two girder sections across all girder lines before proceeding to the next two girder sections. The permanent diaphragms are used during erection, to provide lateral support for subsequent girders. After all girders are erected, the bolts will be torqued and inspected.

Equipment Used:
    Link-Belt 138 HSL
    Link-Belt RTC 80110
    Link-Belt ATC 3210
    Link-Belt RTC 8050 (helper crane for temporary girder support)

Check girder stability:
From NHDOT spec:

> 3.14.2.4 Lifting. Proper consideration shall be given to guard against lateral buckling when lifting beams and girders. Generally speaking, straight beams and girders 30 in. (760 mm) in depth or deeper, lifted according to the following criteria should be stable. Dimensions for length/width ratios are in feet and b equals the minimum width of the flange in compression.
>
> (a) One Crane (Overhang using a single line pickup at the girder centerline with or without a spreader) – For the unsupported overhang length, d, the maximum d/b ratio should not exceed 35 nor should the overhang length exceed 50 ft.
>
> (b) Two Cranes (Distance between beam clamps at the girder ends on a two-point pick-up) – For the unsupported length, a, between beam clamps on a two-point pickup, the a/b ratio should not exceed 85 nor should the distance between pickup points exceed 100 feet.

The girders must be kept stable while lifting, so the NHDOT standard specification 550.3.14.2.4, for lifting of steel girders, will be used to check the girder pick points.

Max interior support: a/b < 85; a_{max} = 85*1.33' = 113', use 100'. **100' max interior support spacing.**

Girder A:
Flange width b = 16" = 1.33' (note: use 25-ton beam clamps for 16"-24" wide flange.)
Max overhang: d/b < 35; d_{max} = 35*1.33' = 46'. Girder length is 82' / 2 = 41' overhang if picked in the middle. 41' < 46', **ok for 1 pick point**.

Girder B:
Flange width b = 20" = 1.66' (note: use 25-ton beam clamps for 16"-24" wide flange.)

Max overhang: $d/b < 35$; $d_{max} = 35*1.66' = 58'$, use 50' max. Girder length is 89' / 2 = 45' overhang if picked in the middle. 45' < 50', **ok for 1 pick point**.

Girder C:
Flange width $b = 16" = 1.33'$ (note: use 25-ton beam clamps for 16"-24" wide flange.)
Max overhang: $d/b < 35$; $d_{max} = 35*1.33' = 46'$. Girder length is 108' / 2 = 54' overhang if picked in the middle. N.G. – need spreader beam.
108' – 46'*2 = 16', need **16' min spreader beam with 31 k = 16 ton capacity.**

Girder D:
Flange width $b = 20" = 1.66'$ (note: use 25-ton beam clamps for 16"-24" wide flange.)
Max overhang: $d/b < 35$; $d_{max} = 35*1.66' = 58'$, use 50' max. Girder length is 89' / 2 = 45' overhang if picked in the middle. 45' < 50', **ok for 1 pick point**.

Girder E:
Flange width $b = 20" = 1.66'$ (note: use 25-ton beam clamps for 16"-24" wide flange.)
Max overhang: $d/b < 35$; $d_{max} = 35*1.66' = 58'$, use 50' max. Girder length is 70' / 2 = 35' overhang if picked in the middle. 45' < 50', **ok for 1 pick point**.

A note about pick overhangs: I understand it is common construction practice to use the above support distances in combination with additional loading from diaphragms, overhang brackets, etc. Such extra weight is relatively small; for this girder, the self-weight is at least 244 lb/ft, vs. approx. 20 lb/ft for diaphragms and hangers.

Load to Pick:
The weight of the pick is based on a single girder, plus any diaphragms and splice plates, and an allowance for rigging (sufficient to include typical spreader beams and beam clamps).

The steel has the following max. piece weights, from the structural steel drawings:
Diaphragms: 295 lb. ea. Allow for 3 diaphragms on typ girders, 4 on girder C
Splice Plates (max): 125*2 + 65*4 + 150*2 + 30*2 = 870 lb * 1.5 for bolts = 1300 lb at end of A&B girders, and both ends of D girders.
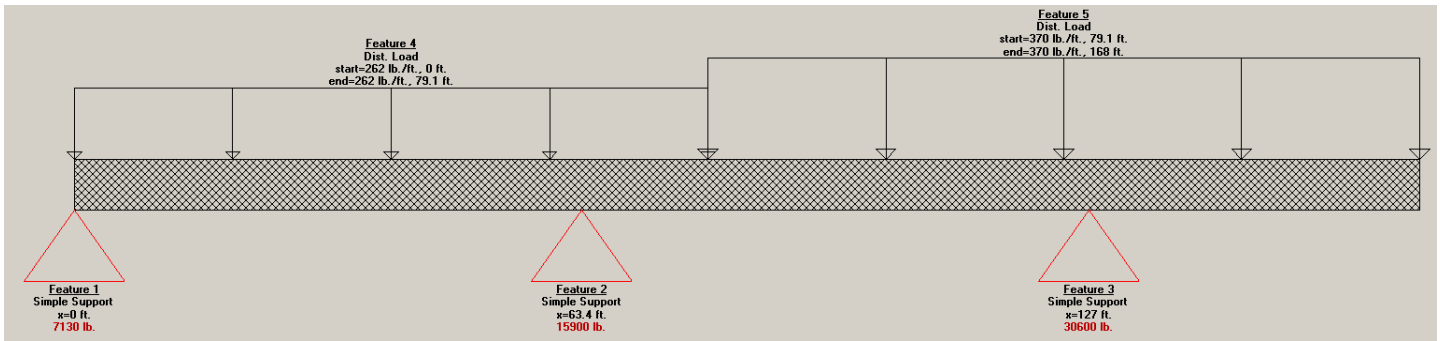Rigging: allow for 2500 lb for block and cable. Girder C has additional 1200 lb for a 20' speader beam

Girder stability with temporary crane supports:
50-ton crane is to hold the first girders while the other cranes set the second girder line.
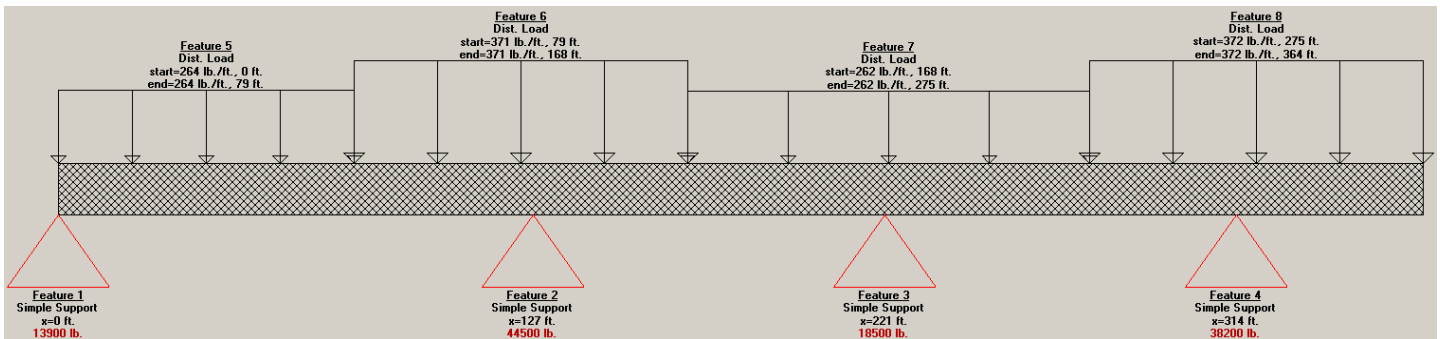
Load on 50-ton crane:
Girders A-B: crane is to lift at midpoint of span 1.

Feature 4
Dist. Load
start=262 lb./ft., 0 ft.
end=262 lb./ft., 79.1 ft.

Feature 5
Dist. Load
start=370 lb./ft., 79.1 ft.
end=370 lb./ft., 168 ft.

Feature 1
Simple Support
x=0 ft.
7130 lb.

Feature 2
Simple Support
x=63.4 ft.
15900 lb.

Feature 3
Simple Support
x=127 ft.
30600 lb.

Support reaction at helper crane = 15.9 k
RTC8050 has capacity = 17.8 k at R = 40', ok radius per drawing.

Girders A-D:

Feature 5
Dist. Load
start=264 lb./ft., 0 ft.
end=264 lb./ft., 79 ft.

Feature 6
Dist. Load
start=371 lb./ft., 79 ft.
end=371 lb./ft., 168 ft.

Feature 7
Dist. Load
start=262 lb./ft., 168 ft.
end=262 lb./ft., 275 ft.

Feature 8
Dist. Load
start=372 lb./ft., 275 ft.
end=372 lb./ft., 364 ft.

Feature 1
Simple Support
x=0 ft.
13900 lb.

Feature 2
Simple Support
x=127 ft.
44500 lb.

Feature 3
Simple Support
x=221 ft.
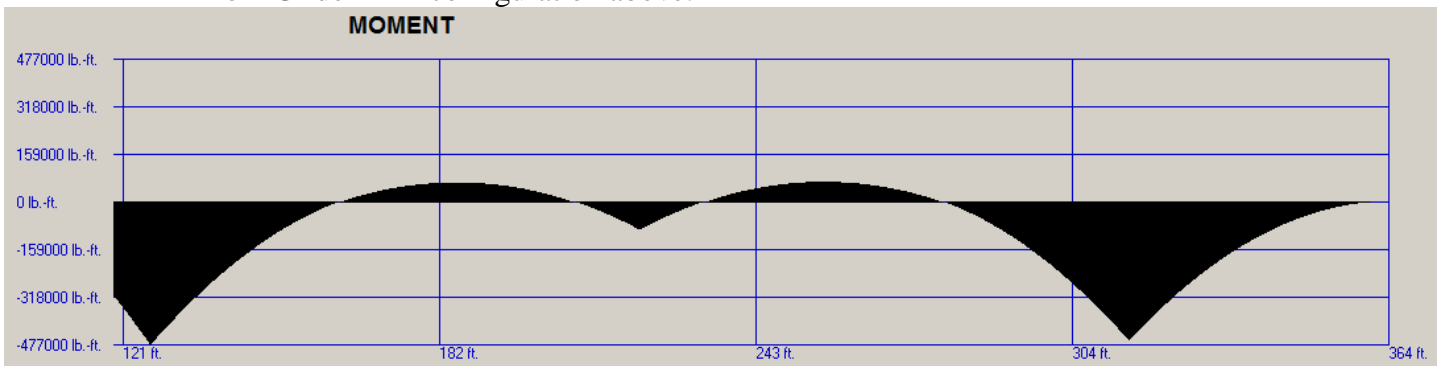18500 lb.

Feature 4
Simple Support
x=314 ft.
38200 lb.

Support reaction at helper crane = 18.5 k
RTC8050 has capacity = 37.9 k at R = 25', ok radius per drawing.

Girder E:
Less unbraced length than girdera A-B. ok by inspection.

Check stability of middle span, with helper crane picking girder. Unbraced length is from last diaphragm on girder section B to pier 2.

From Girder A-D configuration above:

MOMENT

477000 lb.-ft.
318000 lb.-ft.
159000 lb.-ft.
0 lb.-ft.
-159000 lb.-ft.
-318000 lb.-ft.
-477000 lb.-ft.

121 ft.   182 ft.   243 ft.   304 ft.   364 ft.

Lb = 153' = 1836 in from last diaphragm on girder B to pier 2
Unbraced length is comparatively very long vs Lb and Lr; assume elastic LTB. Use section properties for girder C.

$$Mn = Cb*pi()/Lb* \sqrt{ E*Iy*G*J + (pi()*E/Lb)^2 * Iy*Cw } < Mp$$

Cb	2.99
Lb	1836 in
E	29000 ksi
Iy	598 in^4
G	11200 ksi
J	9.18 in^4
Cw	793000 in^6

$$Mp = Fy * Zx = 50 \text{ ksi} * 1749 \text{ in}^4 = 87450 \text{ k-in}$$

Mn = 8788.448 k-in

      < Mp, use value shown.

Mu = 477 k-ft

      5724 k-in

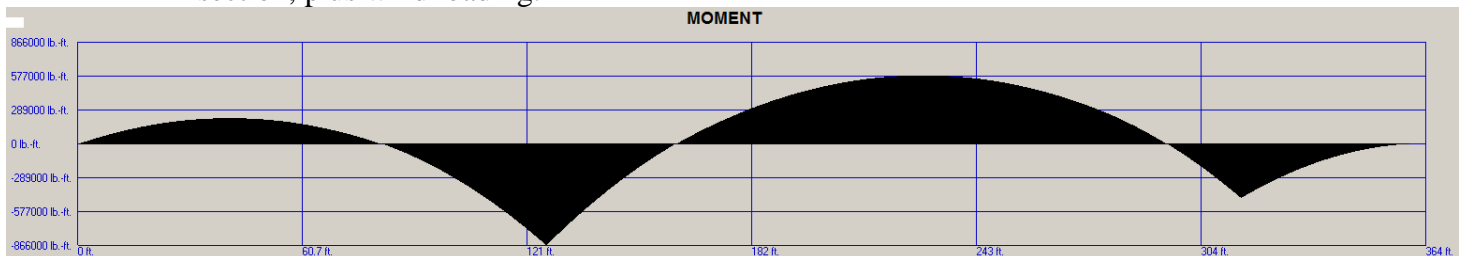   0.65 of Mn, ok.

      also, the helper crane will provide some amount of lateral support

Temporary Bracing at Supports for First Girder:

Temporary bracing must resist 2% or the bending moment resisted by half the girder section, plus wind loading.

The max moment while using the helper crane (assume helper crane is absent to maximize moments) is found to be at pier 1 & 2 while girders A-D are connected. Mmax = 866 k-ft = 10,400 k-in.

For a T-section of half the girder, find the centroid (use smallest section):

	A	ybar	A*ybar
1/2 web	20.25	18	364.50
flange	14	36.4375	510.13
sums:	34.25		874.63

Ybar = 25.54 inches from centroid

Compressive load from bending = 10400 k-in / 2 for compressive component / 25.54 in Ybar = 204 k

Brace load = 204 k * 0.02 = 4 k horizontal brace load.

Wind pressure: take as 30 mph. Wind may add to the brace load, say for 40 mph, pressure (psf) = 0.00256*30 mph^2 = 2.3 psf * 6' height * 2.0 for drag on a flat plate = 28 lb/ft / 2 for top flange * 157' max tributary length = 2.2 k horizontal wind force.

Total horizontal brace load = 4 k + 2.2 k = 6.2 k. Total axial brace load for 45-deg brace = 6.2 k / sin(26) = 14 k axial load total. Divide among several braces.

For **1 brace each side of girder,** each brace must support 14 k axial load. By inspection, this force is resisted by min 2 runs of 3/8" cable (SWL = 14,840 lb / 2 = 7.4 k ea) or chains connected to plate hooks at the girder, and tied down to adjacent anchor bolts. Note the bracing material is to have SWL = 14,000 lb.

Worker Protection:

Workers will be allowed on the erected steel only while all girders are braced with diaphragms or temporary bracing as indicated above, or the workers are in manlifts or man baskets. To allow worker access to the steel, fall protection posts and cable will be installed on girders prior to erection. The DBI/Sala Protecta fall protection system requires cable supports every 60' at maximum, so three posts will be used on the 124' girders, and two posts on the 38' girders. After splicing, the fall protection lines will be strung the whole length of the bridge.

Attachments:

Crane Charts
Beam Clamps Information
Fall Protection Posts Information
Steel Erection Plan, sheet 1/1

138 HSL
110' of Boom

Tube Boom Load Chart

	Tube Boom Lift Capacity Chart – 360° Rotation ABC = 52,320 lb (23 732kg) Counterweight – Side Frames Extended [All capacities are listed in kips (mt)]									
Load Radius ft (m)	Boom Length – ft (m)									
	40 (12.2)	50 (15.2)	60 (18.3)	70 (21.3)	80 (24.4)	90 (27.4)	100 (30.5)	110 (33.5)	120 (36.6)	130 (39.6)
11 (3.4)	160.0 (72.6)									
12 (3.7)	160.0 (72.6)	160.0 (72.6)								
13 (4.0)	151.8 (68.9)	151.6 (68.8)								
14 (4.3)	141.6 (64.2)	141.4 (64.1)	141.1 (64.0)							
15 (4.6)	132.6 (60.1)	132.4 (60.1)	132.2 (60.0)							
16 (4.9)	124.7 (56.6)	124.5 (56.5)	124.3 (56.4)	123.9 (56.2)						
17 (5.2)	117.6 (53.3)	117.5 (53.3)	117.3 (53.2)	117.0 (53.1)						
18 (5.5)	111.1 (50.4)	111.2 (50.4)	111.0 (50.3)	110.7 (50.2)	109.0 (49.4)					
19 (5.8)	101.7 (46.1)	101.9 (46.2)	102.0 (46.3)	102.1 (46.3)	102.1 (46.3)	99.3 (45.0)				
20 (6.1)	93.7 (42.5)	93.9 (42.6)	94.0 (42.6)	94.1 (42.7)	94.1 (42.7)	94.0 (42.6)				
25 (7.6)	67.0 (30.4)	67.1 (30.4)	67.2 (30.5)	67.2 (30.5)	67.1 (30.4)	67.1 (30.4)	67.0 (30.4)	66.9 (30.3)	66.8 (30.3)	
30 (9.1)	51.8 (23.5)	51.9 (23.5)	52.0 (23.6)	52.0 (23.6)	51.9 (23.5)	51.8 (23.5)	51.7 (23.5)	51.6 (23.4)	51.5 (23.4)	51.4 (23.3)
35 (10.7)	42.0 (19.1)	42.2 (19.1)	42.2 (19.1)	42.1 (19.1)	42.1 (19.1)	42.0 (19.1)	41.9 (19.0)	41.8 (19.0)	41.6 (18.9)	41.5 (18.8)
40 (12.2)	35.1 (15.9)	35.3 (16.0)	35.3 (16.0)	35.3 (16.0)	35.2 (16.0)	35.1 (15.9)	35.0 (15.9)	34.9 (15.8)	34.7 (15.7)	34.6 (15.7)
50 (15.2)		26.3 (11.9)	26.4 (12.0)	26.4 (12.0)	26.3 (11.9)	26.2 (11.9)	26.0 (11.8)	25.9 (11.7)	25.8 (11.7)	25.6 (11.6)
60 (18.3)				20.8 (9.4)	20.7 (9.4)	20.6 (9.3)	20.4 (9.3)	20.3 (9.2)	20.2 (9.2)	20.0 (9.1)
70 (21.3)					16.9 (7.7)	16.7 (7.6)	16.6 (7.5)	16.5 (7.5)	16.3 (7.4)	16.2 (7.3)
80 (24.4)						14.0 (6.4)	13.8 (6.3)	13.7 (6.2)	13.5 (6.1)	13.4 (6.1)
90 (27.4)							11.7 (5.3)	11.6 (5.3)	11.4 (5.2)	11.3 (5.1)
100 (30.5)								9.9 (4.5)	9.8 (4.4)	9.6 (4.4)
110 (33.5)									8.4 (3.8)	8.3 (3.8)
120 (36.6)										7.1 (3.2)

Link-Belt RTC 80110:

Main Boom Lift Capacity Charts — Imperial

Radius (ft)	26,000 lb Counterweight — Fully Extended Outriggers — 360° Rotation (All Capacities Are Listed In Pounds)												Radius (ft)
	Boom Length (ft)												
	40	50	60	70	80	90	100	110	120	130	140	150	
10	*220,000	107,200	105,400	101,500									10
12	187,600	107,200	105,400	101,500	101,300								12
15	164,600	107,200	105,400	101,500	96,600	81,900	56,500						15
20	123,400	107,200	105,400	101,500	80,800	73,200	65,900	56,000					20
25	95,800	95,400	94,000	87,800	69,000	62,700	60,100	56,000	58,000				25
30	77,200	76,900	76,600	76,300	59,900	55,000	53,500	56,000	51,300	48,600	38,400	30,000	30
35		63,700	63,400	63,200	53,200	53,000	53,500	51,800	45,400	43,100	38,400	30,000	35
40		52,400	52,000	52,000	53,200	52,800	52,800	46,300	40,600	38,500	37,000	30,000	40
45			43,600	44,200	44,700	42,900	43,000	41,700	36,500	34,600	33,300	30,000	45
50			36,100	36,900	37,300	37,600	35,600	35,700	33,000	31,300	30,200	29,100	50
55				31,300	31,800	32,100	30,200	30,300	30,000	28,500	27,500	26,500	55
60				26,800	27,300	27,600	27,900	25,900	25,900	25,900	25,100	24,200	60
65					23,700	24,000	24,300	23,600	22,400	22,400	22,400	22,100	65
70					20,700	21,100	21,300	21,500	19,900	19,500	19,500	19,500	70
75						18,600	18,800	19,000	18,500	17,100	17,200	17,200	75
80						16,500	16,800	17,000	17,200	15,100	15,100	15,200	80
85							14,900	15,200	15,400	13,300	13,300	13,400	85
90							13,300	13,600	13,800	11,700	11,800	11,800	90
95								12,200	12,400	10,400	10,400	10,400	95
100								10,900	11,100	9,100	9,120	9,200	100
105									10,000	8,100	8,100	8,100	105
110									9,000	7,100	7,100	7,100	110
115										6,200	6,200	6,300	115
120										5,400	5,400	5,500	120
125											4,700	4,800	125
130											4,000	4,100	130
135												3,500	135
140												2,900	140

* Special conditions or optional equipment required

Link-Belt ATC 3210:

5654-1013-S3 Preliminary

115,500 lb Counterweight - Fully Extended Outriggers - 360° Rotation
(All Capacities Are Listed In Pounds)

Radius (ft)	44.3	58.9–59.8	73.5–75.9	88.6–92.4	103.7–107.5	119.3–124.1	134.9–136.8	151.9–153.3	167–168.9	183.6–185.5	200.1	Radius (ft)
8	420,000 **											8
10	300,000	297,300	262,200	212,200								10
12	268,200	269,500	256,800	212,200								12
15	233,200	235,200	232,200	205,500	128,900							15
20	189,400	192,100	191,000	184,600	172,300	129,700	91,400					20
25	157,800	160,900	160,000	158,700	153,000	120,900	91,400	73,000	41,200			25
30	133,000	137,200	136,300	135,000	136,500	118,300	85,500	73,000	55,000	41,300		30
35	111,300	115,700	117,000	116,700	115,300	107,800	79,100	73,000	55,000	41,300	33,000	35
40		99,400	100,700	100,500	99,200	98,900	73,500	69,700	55,000	41,300	33,000	40
45		87,400	87,800	87,700	86,500	88,000	68,600	63,800	55,000	41,300	33,000	45
50		76,100	77,500	77,400	77,400	77,900	64,100	58,800	53,500	41,300	33,000	50
55			70,700	70,800	70,800	69,400	60,400	54,300	50,500	41,300	33,000	55
60			63,700	64,200	63,800	62,400	57,000	50,100	47,600	40,200	33,000	60
65			55,900	58,200	57,700	56,300	54,000	46,500	44,300	37,800	33,000	65
70				53,000	52,500	51,300	51,300	43,300	41,400	35,600	33,000	70
75				48,500	48,000	46,800	48,100	40,500	38,700	33,700	32,600	75
80				42,200	44,100	42,900	44,100	37,900	36,400	31,900	30,800	80
85					40,100	40,000	40,100	35,800	34,200	30,200	29,100	85
90					38,600	38,000	36,600	33,400	32,200	28,600	27,600	90
95					33,600	34,900	33,700	31,700	30,300	27,200	26,200	95
100						32,300	31,000	30,400	28,600	25,800	25,000	100
105						29,900	28,500	29,100	27,100	24,400	23,800	105
110						25,000	26,400	27,100	25,800	23,000	22,400	110
115						20,600	24,400	25,100	24,100	21,600	21,400	115
120							23,300	23,300	22,300	20,400	20,400	120
125							21,000	21,700	20,700	19,400	19,600	125
130								20,200	19,200	18,300	18,700	130
135								18,800	17,800	17,100	17,700	135
140								17,600	16,700	15,900	16,700	140
145									15,500	15,000	15,600	145
150									14,500	14,400	14,500	150
155									13,500	13,800	13,500	155
160									10,200	13,200	12,500	160
165										12,500	11,700	165
170										11,700	10,800	170
175										9,300	10,100	175
180											9,400	180
185											8,700	185

Note: Capacities depict multiple boom modes.
** Over rear intermediate outriggers, additional equipment required.

Link-belt RTC 8050 II:

Rated Lifting Capacities In Pounds — Fully Extended Outriggers — See Set Up Note 2 — FULL — MAIN BOOM "A"

Load Radius (Ft.)	35.5 Ft. ∠°	360°	Over Front	40 Ft. ∠°	360°	Over Front
10	68.0	100,000	100,000	70.5	78,400	78,400
12	64.5	73,900	75,400	67.5	73,100	73,100
15	58.5	63,200	64,400	62.5	63,000	63,800
20	48.0	50,300	51,300	54.0	50,100	51,200
25	34.5	39,000	40,900	44.0	38,900	40,700
30				31.0	30,800	32,300
Min.Bm. Ang.Cap.	0 (30.0)	17,800	17,800	0 (34.5)	15,300	15,300

Load Radius (Ft.)	50 Ft. ∠°	360°	Over Front	60.3 Ft. ∠°	360°	Over Front
10	75.0	72,600	72,600			
12	72.5	65,600	65,600	76.5	50,900	50,900
15	69.0	57,500	57,500	73.5	46,900	46,900
20	62.5	47,600	47,600	68.5	39,200	39,200
25	55.5	38,500	40,200	63.0	33,400	33,400
30	48.0	30,500	32,100	57.5	28,700	28,700
35	39.0	24,800	26,100	51.0	24,600	25,200
40	27.5	19,100	20,400	44.0	18,900	20,200
45				36.0	14,900	16,000
50				26.0	11,800	12,800
Min.Bm. Ang.Cap.	0 (44.5)	10,100	10,100	0 (54.8)	6,500	6,500

Rated Lifting Capacities In Pounds — Fully Extended Outriggers — See Set Up Note 2 — FULL — MAIN BOOM "B"

Load Radius (Ft.)	35.5 Ft. ∠°	360°	Over Front	40 Ft. ∠°	360°	Over Front	50 Ft. ∠°	360°	Over Front
10	68.0	100,000	100,000	70.5	37,900	37,900	74.5	37,900	37,900
12	64.5	73,900	75,400	67.5	37,900	37,900	72.5	37,900	37,900
15	58.5	63,200	64,400	62.5	37,900	37,900	69.0	37,900	37,900
20	48.0	50,300	51,300	54.0	37,900	37,900	62.5	37,900	37,900
25	34.5	39,000	40,900	44.0	37,900	37,900	55.5	37,900	37,900
30				31.0	31,300	32,900	48.0	31,900	33,500
35							39.0	26,100	27,500
40							27.5	20,800	22,100
Min.Bm Ang Cap	0 (30.0)	17,800	17,800	0 (34.5)	14,700	14,700	0 (44.5)	9,900	9,900

Load Radius (Ft.)	60 Ft. ∠°	360°	Over Front	70 Ft. ∠°	360°	Over Front	80 Ft. ∠°	360°	Over Front
10	77.5	37,900	37,900						
12	76.0	37,900	37,900	78.0*	37,900	37,900			
15	73.0	37,900	37,900	76.0	37,900	37,900	78.0*	35,400	35,400
20	68.0	37,900	37,900	72.0	37,900	37,900	74.5	34,700	34,700
25	62.5	37,900	37,900	67.5	37,900	37,900	71.0	34,200	34,200
30	56.5	32,300	33,900	62.5	32,500	32,800	67.0	30,300	30,300
35	50.5	26,500	27,800	57.5	26,700	28,100	63.0	26,900	27,200
40	43.5	21,200	22,500	52.5	21,400	22,700	58.5	21,500	22,800
45	35.5	17,100	18,200	46.5	17,300	18,400	54.0	17,400	18,500
50	25.0	13,900	14,900	40.5	14,200	15,200	49.0	14,300	15,300
55				33.0	11,900	12,700	44.0	12,100	12,800
60				23.5	10,000	10,700	38.0	10,200	10,900
65							31.0	8,600	9,300
70							22.0	7,300	7,900
MinBm Ang Cap	0 (54.5)	7,000	7,000	0 (64.5)	5,000	5,000	0 (74.5)	3,500	3,500

| Load Radius (Ft.)	90 Ft. ∠°	360°	Over Front	100 Ft. ∠°	360°	Over Front	110 Ft. ∠°	360°	Over Front
20	77.0	28,900	28,900						
25	74.0	28,200	28,200	76.0	24,000	24,000	77.5	19,500	19,500
30	70.5	24,800	24,800	73.0	22,500	22,500	75.0	19,500	19,500
35	67.0	22,000	22,000	70.0	19,900	19,900	72.5	18,300	18,300
40	63.5	19,700	19,700	67.0	17,800	17,800	70.0	16,400	16,400
45	59.5	17,500	17,800	63.5	15,900	15,900	67.0	14,600	14,600
50	55.5	14,400	15,400	60.5	14,400	14,400	64.0	13,200	13,200
55	51.0	12,200	12,900	56.5	12,200	13,000	61.0	12,100	12,100
60	46.5	10,300	11,000	53.0	10,300	11,100	57.5	10,400	11,000
65	41.5	8,700	9,400	49.0	8,800	9,500	54.0	8,900	9,600
70	36.0	7,500	8,100	44.5	7,500	8,200	50.5	7,600	8,200
75	29.5	6,400	6,900	40.0	6,500	7,100	47.0	6,500	7,100
80	21.0	5,400	6,000	34.5	5,500	6,100	42.5	5,600	6,200
85				28.5	4,700	5,200	38.5	4,800	5,300
90				20.5	4,000	4,500	33.5	4,100	4,600
95							27.5	3,500	3,900
100							20.0	2,900	3,400
MinBm Ang Cap	0 (84.5)	2,400	2,400	0 (94.5)	1,600	1,600	0 (104.5)	900	900

BEAM CLAMPS

Beam clamps provide an efficient method for handling wide flange beam sections and plate girders. When lifting, they grip the beam at three points. When properly balanced and safely guided, the beam can be handled even if the clamp is slightly off center lengthwise.

Good safety procedures providing control of the lifted beam must be used. Beams should be gripped as near the center as possible. Snubbing lines at each end must be used to control excessive twisting or swinging, and to guide the beam to its proper place. Each lifting situation may have specific safety demands which should be used as required.

Beam clamps eliminate the need for slings, chokers, and spreader bars. The weight of the beam clamp automatically opens its tongs, which slide under the flanges of the beam. When the clamp is lifting, its center plate and gripping tongs work against each other—the heavier the beam, the greater the clamping pressure.

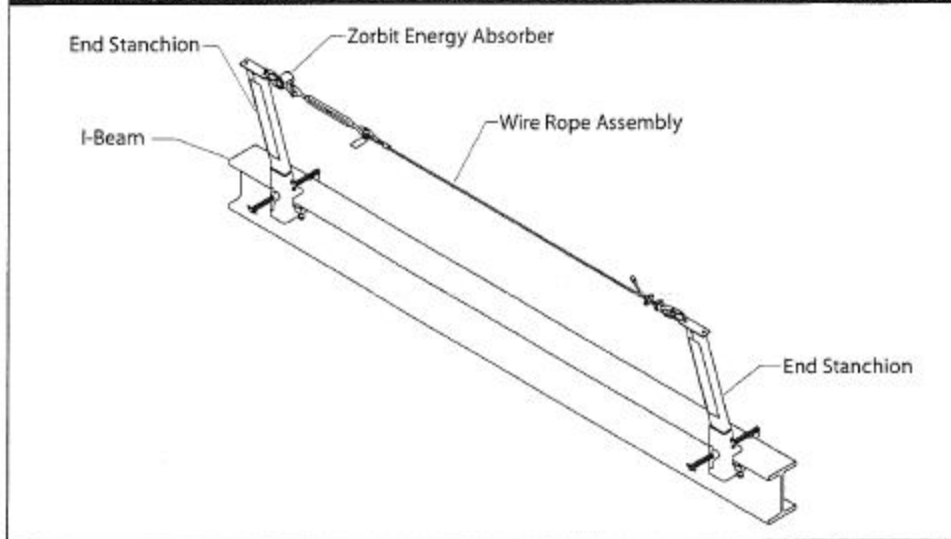Model "NS" clamps have a recessed base to accept studs welded to a beam surface.
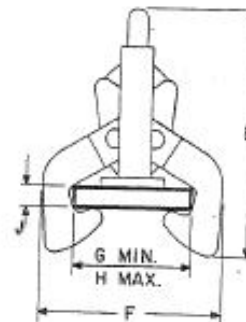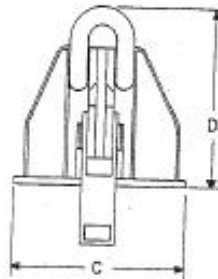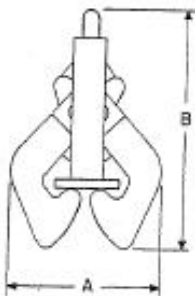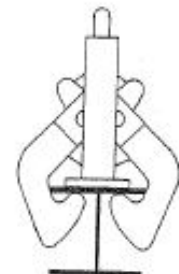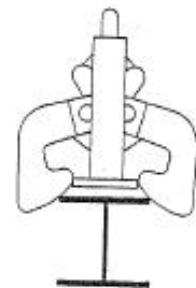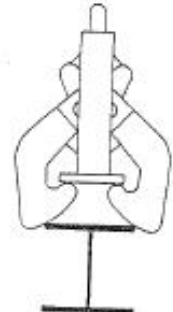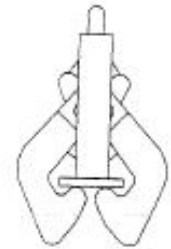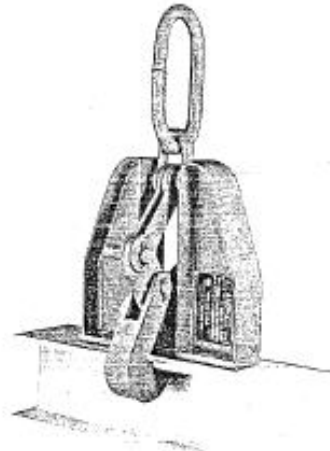
Model No.	Working Load Limit Tons	FlangeGrip Width Range Min. Max.	Depth	Wt. Lbs.	Dimensions A	B	C	D	E	F	G	H	J
F-5	5	4 to10	1	51	9 1/2	26	12	20	25 1/2	16 3/4	4	10	1
F-15	15	7 to17	2	125	15 1/2	34	17	27	34 1/2	25	7	17	2
NS-15	15	7 to17	2	120	15 1/2	34	17	27	34 1/2	25	7	17	2
F-25	25	16 to 24	3	244	23	48	22 1/4	36	53	37 1/4	16	24	3
NS-25	25	16 to 24	3	234	23	48	22 1/4	36	53	37 1/4	16	24	3
F-35	35	16 to 36	4	495	30	64	27 1/2	48	58	53	16	36	4
NS-35	35	16 to 36	4	484	30	64	27 1/2	48	58	53	16	36	4
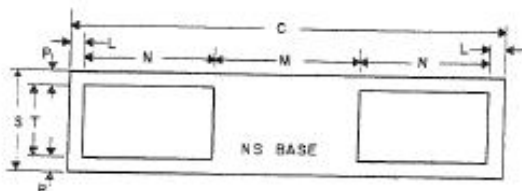
Model Number	NS Base Dimensions, Inches S	C	N	T	M	L	P
NS-15	4	16 1/2	4 1/2	2 1/2	6 1/2	1/2	3/4
NS-25	5 1/2	22 1/4	6 1/2	4	7 3/4	3/4	3/4
NS-35	6	27 1/2	8 1/2	4 1/2	9	3/4	3/4

NS BASE

WARNING: Decreasing the load by bumping or substantial imbalance can, under certain circumstances, loosen the grip. Do not use on flange widths less than those specified on the name plate. Do not exceed working load limit.

Figure 1 - SecuraSpan® Single Span Horizontal Lifeline

End Stanchion
Zorbit Energy Absorber
Wire Rope Assembly
I-Beam
End Stanchion

Figure 2 - SecuraSpan® Multiple Span Horizontal Lifeline

Zorbit Energy Absorber
End Stanchion
Wire Rope Assembly
I-Beam
Intermediate Bracket Assembly
Zorbit Energy Absorber
End Stanchion
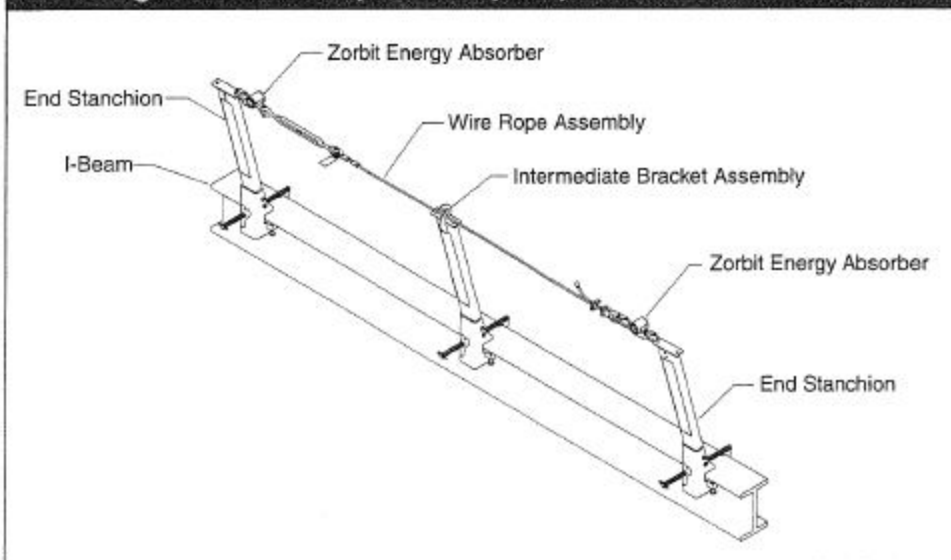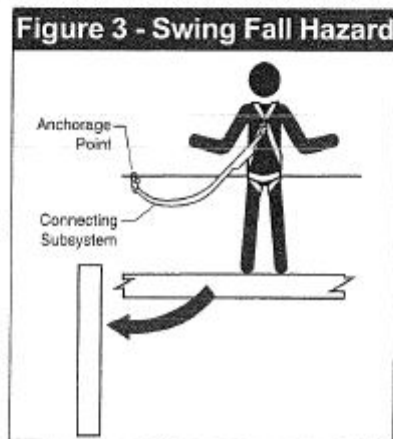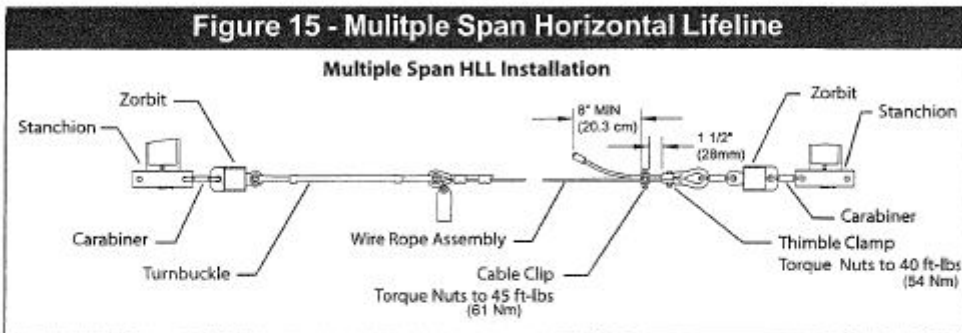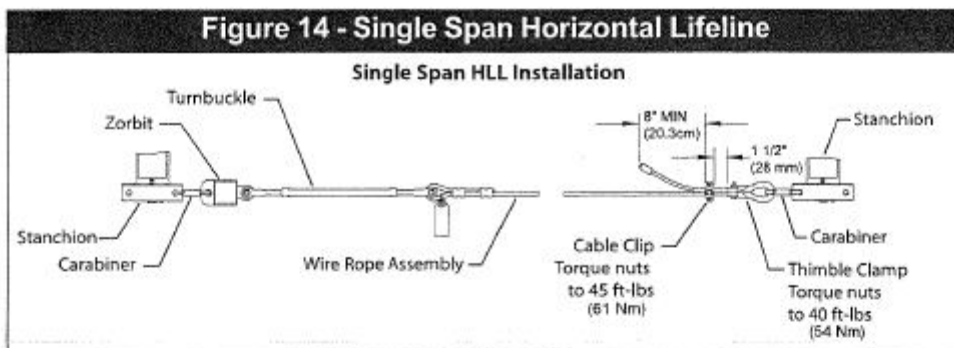
1.0   APPLICATION

1.1   **PURPOSE:** SecuraSpan® Horizontal Lifeline systems (HLL) are designed to be used as an anchoring means for up to six personal fall arrest systems (PFAS). The SecuraSpan system may be used in many situations where a combination of horizontal mobility and fall protection is needed. Figures 1 and 2 show two configurations of the SecuraSpan HLL systems.

1.2   **LIMITATIONS:** The following limits apply to the installation and use of the SecuraSpan Horizontal Lifeline System. Other limitations may apply.

> **IMPORTANT:** *OSHA regulations state that horizontal lifelines shall be installed and used under the supervision of a qualified person (see below for definition) as part of a complete personal fall arrest system that maintains a safety factor of at least two.*
>
> **Qualified Person:** *An individual with a recognized degree or professional certificate, and extensive knowledge and experience in the subject field, who is capable of design, analysis, evaluation, and specification in the subject work, project, or product. Refer to OSHA 1910.66, 1926.32, and 1926.502.*

A. **HORIZONTAL LIFELINE SPAN:** The maximum horizontal lifeline span length is 60 ft. (18.3 m). The system length can be extended by using multiple spans. See Figure 2. The span length must be reduced when clearance is limited. See section 3.0 for clearance information

B. **ANCHORAGES:** SecuraSpan® Horizontal Lifeline (HLL) systems must only be installed to anchorages capable of meeting the strength requirements specified in Section 2.4.

C. **SYSTEM CAPACITY:** The capacity of single span systems is two persons. The capacity of multiple span systems is two persons secured on each span with a maximum of six people installed on the system. The maximum weight of each person, including tools and clothing, is 310 lbs (141 kg).

D. **CONNECTING SUBSYSTEM:** Each person's connecting subsystem (energy absorbing lanyard or SRL) must limit fall arrest forces to 900 lbs. (4 kN) or less. See section 2.1.

E. **FREE FALL:** Rig and use the personal fall arrest system such that the maximum potential free fall does not exceed government regulatory and subsystem manufacturer's requirements. See section 3.0 and subsystem manufacturer's instructions for more information.

F. **SWING FALLS:** See Figure 3. Swing falls occur when the anchorage point is not in line vertically with the worker. The force of striking an object in a swing fall may cause serious injury or death. Minimize swing falls by working as directly in line with the anchorage point as possible. Do not permit a swing fall if injury could occur. Swing falls will significantly

Figure 3 - Swing Fall Hazard

Anchorage Point

Connecting Subsystem

Figure 14 - Single Span Horizontal Lifeline

Single Span HLL Installation

- Turnbuckle
- Zorbit
- Stanchion
- Carabiner
- Wire Rope Assembly
- 8" MIN (20.3cm)
- 1 1/2" (28 mm)
- Stanchion
- Cable Clip Torque nuts to 45 ft-lbs (61 Nm)
- Carabiner
- Thimble Clamp Torque nuts to 40 ft-lbs (54 Nm)

Figure 15 - Mulitple Span Horizontal Lifeline

Multiple Span HLL Installation

- Zorbit
- Stanchion
- Carabiner
- Turnbuckle
- Wire Rope Assembly
- 8" MIN (20.3 cm)
- 1 1/2" (28mm)
- Cable Clip Torque Nuts to 45 ft-lbs (61 Nm)
- Zorbit
- Stanchion
- Carabiner
- Thimble Clamp Torque Nuts to 40 ft-lbs (54 Nm)

is 6 in. (15.25 cm) or less, with no weight on the wire rope. The turnbuckle will not over tension the wire rope.

Step 6. After pre-loading the system, re-torque all cable clips to values specified previously.

NOTE: Two independent SecuraSpan HLL systems may be terminated at the same stanchion.

3.3 OPERATION:

A. PERSONAL FALL ARREST SYSTEM COMPONENTS: Inspect and don the full body harness according to manufacturer's instructions. Attach the connecting subsystem (energy absorbing lanyard or SRL) to the dorsal connection on the harness.

WARNING: Risk of swing falls is greater when using an SRL. Swing falls significantly increase the clearance required to arrest a fall and may result in serious injury or death. To avoid swing fall hazards, do not work beyond the end stanchions or at excessive distances to either side of the HLL system. Do not climb above the HLL system.

B. CONNECTING TO THE HLL SYSTEM: Approach the work area using the appropriate access equipment. Connect the personal fall arrest system (the free snap hook on the enegry absorbing lanyard or carabiner attached to the SRL) to the horizontal lifeline.